

SEAMLESS FOAM PANEL ROOFING SYSTEM

FIELD OF THE INVENTION

5 The present invention relates to roofing systems.

BACKGROUND OF THE INVENTION

10 Rigid foam panels are currently available for use as an
insulating underlayment in roof construction. Typically these are
4' by 8' (1.22m by 2.44m) panels 1.5" (3.8cm) thick made of a 1.6
pound per cubic foot polyurethane foam with a tar paper top
layer. Such a material is not crush resistant enough to be used
as a roof surface material and can also be easily punctured.

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OBJECTS OF THE INVENTION

It is therefore an object of the present invention to
provide a sturdy, weatherproof, seamless roofing system that uses
20 rigid foam boards or panels to create a seamless waterproof roof.

SUMMARY OF THE INVENTION

25 The roofing panels of this invention differ from the prior
art underlayment product in several respects. The panels of this

invention are:

a) made of a denser polyurethane foam (approximately 3 pounds per cubic foot) and,

b) include an integral top layer of non-woven 250 gram polyester fabric that is saturated by the foam during manufacture by the laminator in a controlled factory environment.

The higher density affords more crush resistance, while the well bonded top layer resists punctures and provides a better adhesion surface for elastomeric top coats.

The roofing panels are bonded to roof substrate with low rise foam polyurethane adhesive which seeps through loose tongue-in-groove joints to form a blob at the top, which is shaved off and covered with a fabric top layer.

After the adhesive cures, a very secure bond between the panels results.

The low rise foam adhesive is a two-part mixture that has distinct phases after mixing. By varying the formulations of the two parts, the "cream time" (i.e.- to achieve the consistency of shaving cream) as well as the "tack free" time can be controlled.

The panels are placed on the foam just after cream consistency and well before tack-free time so that the foam rises through the joints. After the adhesive cures to a solid consistency, the blobs are removed from all of the joints. This is typically accomplished by grinding using a disk pad grinder.

The roof is finished by applying a layer of waterproof elastomeric coating which covers the entire surface creating a

monolithic structure.

BRIEF DESCRIPTION OF THE DRAWINGS

5 The present invention can best be understood in connection with the accompanying drawings, in which:

Fig. 1 is a top plan view of a roof section; showing outlines of roofing panels of this invention;

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Fig. 2 is a top plan view of an embodiment for a tongue-in-groove roofing panel of this invention;

Fig. 3 is an edge cross-section detail view of further
15 embodiment for an all-groove panel of this invention with an insertable tongue board;

Fig. 4 is an edge cross-section view of yet another embodiment for tongue-in-groove roofing panels of this invention, shown
20 adhesively bonded to a roof substrate;

Fig. 5 is an edge cross-section detail view of a still further alternate embodiment of this invention, shown with a ship-lap joint configuration;

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Fig. 6 is an edge cross-section detail view showing a panel

joint of this invention in a finished roof section;

Fig. 7 is a high level flow chart of the roofing system method of this invention; and,

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Fig. 8 is a roof edge detail view in crossection, illustrating flashing and interfacing to the roofing system of this invention.

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DETAILED DESCRIPTION OF THE INVENTION

The roofing system of this invention uses rigid foam boards or panels to create a seamless waterproof roof. It can be used over a number of different substrates including metal decking, tar and gravel, or polyurethane foam in new construction as well as re-roofing applications.

Rigid foam panels are currently available for use as insulating underlayment in roof construction. Typically these are 4' by 8' (1.22m by 2.44m) panels 1.5" (3.8cm) thick made of a 1.6 pound per cubic foot polyurethane foam with a tar paper top layer. Such a material is not crush resistant enough to be used as a roof surface material and can also be easily punctured.

The roofing panels of this invention differ from this underlayment product in several respects. Although panel size as well as material are similar, the panels of this invention are

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made of a denser polyurethane foam (approximately 3 pounds per cubic foot) and include an integral top layer of non-woven 250 gram polyester fabric that is saturated by the foam during manufacture by the laminator in a controlled factory environment.

5 The higher density affords more crush resistance, while the well bonded top layer resists punctures and provides a better adhesion surface for elastomeric top coats.

Figure 1 is a top view of a roof 1 section showing the outline of the individual roof panels. The panel seams are
10 staggered by using alternate whole panels A as well as half panels B at the roof edge 2. This is done to prevent any tendency for propagation of inadvertent seam separations.

Figure 2 shows a top view of a tongue-in groove panel 5 tongue edges 6 and groove edges 7.

15 Since a protruding tongue of polyurethane foam could be damaged in transit, an alternate embodiment of a tongue-in groove construction is shown in Figure 3. In this all-groove construction, each polyurethane panel 10 has grooves 11 cut in all four edges. A length of polyurethane plank 12 is then
20 inserted in groove 11 on two edges at the work site. Plank 12 is dimensioned as a press fit in groove 11 and protrudes from the edge to form the tongue after insertion. Planks 12 would be shipped separately in protective packaging to the work site.

Figure 4 is an edge crosssection view of roofing panels 5
25 bonded to roof substrate 16 with low rise foam polyurethane adhesive 17 which seeps through loose tongue-in-groove joints to

form a blob 18 at the top. Factory bonded fabric 15 is a top layer. Typically, the groove 7 is 7/8" (22 mm) wide while the tongue is 3/4" (19mm) wide; this affords enough space for the adhesive foam to rise through while affording close line-up of the top surfaces of adjacent boards 5. After adhesive 17 cures, a very secure bond between panels 5 results.

Figure 5 is a detail of an alternative panel joint. Here panels 20 have a ship-lap edge which is also dimensioned so as to permit rising foam adhesive to flow through the joint. For ship-lap panels 20, the order in which they are laid into the foam is important.

As shown in Figure 5, panel X should be laid down before panel Y so that there would not be a tendency to lift panel Y during the foam rising phase.

Foam adhesive is a two-part mixture that has distinct phases after mixing. By varying the formulations of the two parts, the "cream time" (i.e.- to achieve the consistency of shaving cream) as well as the "tack free" time can be controlled. For this invention, a cream time of about 1 minute and a tack-free time of about 4 minutes is ideal. The panels are placed on the foam just after cream consistency and well before tack-free time so that the foam rises through the joints.

After the adhesive cures to a solid consistency, the blobs 18 are removed from all of the joints. This is typically accomplished by grinding using a cutter, such as a knife or disk pad grinder. At this stage, the joint is flush with the fabric

top surface of the adjacent panels.

The roof is finished by applying a layer of waterproof elastomeric coating which covers the entire surface creating a monolithic structure.

5 Figure 6 is a detail of a finished joint between two panels
5 after the blob 18 has been removed and elastomeric coating 25
has been applied. Coating 25 can be an acrylic, urethane or
silicone material. It can be sprayed or brushed on.

10 Flow chart 7 is a concise description of the overall
installation process. Two people are generally involved as a
team. One worker sprays a panel-width line of low rise
polyurethane adhesive, while the second worker follows (after the
mix is of cream consistency) and lay down panels. As per Figure
1, the first panel at an edge is either a full or half panel to
15 create the staggered seam pattern. Only after the entire roof (or
large section) is paneled, are the seep-through joint blobs
removed. All debris must be removed carefully before a final seal
coat is applied.

20 Penetrations and wall flashings are first sealed with spray
foam prior to sealing.

 Figure 8 is a detail at a roof edge showing an end panel 5
interfacing with aluminum edging 30 which bridges wall 31, beam
29 and foam panel 5. A V-groove 28 is cut from the corner of
panel 5 at the juncture of edging 30 to permit an aluminum
25 surface to be bonded and sealed to the fabric 15 top layer by
waterproof coating 25.

It is further noted that other modifications may be made to the present invention, within the scope of the invention, as noted in the appended Claims.